

NIOSH SCIENCE AWARDS RESULTS BOOKLET FOR 2016 PROGRAM



DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health



NIOSH

Cover: The images on the cover of the *NIOSH Science Awards Results Booklet for 2016* represent the five NIOSH Scientific Awards presented annually.

Top, left: photo of Alice Hamilton, representing the Alice Hamilton Awards for Occupational Safety and Health

Top, right: photo of James P. Keogh, representing the James P. Keogh Award for Outstanding Service in Occupational Safety and Health

Bottom, left: logo for the Director's Intramural Awards for Extraordinary Science

Bottom row, middle: photo of Charles C. Shepard, representing the Charles C. Shepard Science Award

Bottom row, right: logo for the Bullard-Sherwood Research-to-Practice Award



NIOSH Science Awards 2015

DEPARTMENT OF HEALTH AND HUMAN SERVICES
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NIOSH Presents 2016 Awards for Significant Scientific Contributions

The National Institute for Occupational Safety and Health (NIOSH) has recognized several NIOSH researchers and partners for their significant contributions in 2015 to the field of occupational safety and health.

The annual awards are an opportunity for NIOSH to honor researchers for excellence in science that informs and supports the prevention of work-related injuries, illnesses, and deaths. The awards include the following:

- The **Alice Hamilton Award**, for scientific excellence of technical and instructional materials by NIOSH scientists and engineers.
- The **James P. Keogh Award**, for outstanding service by an individual in the occupational safety and health field.
- The **Bullard-Sherwood Research-to-Practice Award**, for exceptional efforts by NIOSH researchers and partners in applying occupational safety and health research to the prevention of workplace fatalities, illnesses, or injuries.
- The **Director's Award for Extraordinary Intramural Science**.
- Nominations to represent NIOSH for the **Charles C. Shepard Award**, an honor recognizing outstanding contributions to science awarded annually by the Centers for Disease Control and Prevention.



**John Howard, M.D.,
NIOSH Director**

“Strategic research stimulates the scientific evidence, practices, and technologies that are essential for keeping workplaces safe and healthy,” said NIOSH Director John Howard, M.D. “We are proud to recognize the dedicated employees of NIOSH and their partners, whose contributions engage the changing demands of the twenty-first century workplace while continuing our progress against persistent legacy hazards.”

Alice Hamilton Award

Named after Dr. Alice Hamilton, a pioneering researcher and occupational physician, the Alice Hamilton Award is given for outstanding contributions in the areas of biological sciences, engineering and physical sciences, human studies, and educational materials. The submissions go through a rigorous review by panels of scientific experts, including peers from both outside and inside NIOSH. The awardees have contributed to an array of sectors, highlighting the broad range of occupational safety and health. Among other accomplishments, research and outreach by this year's awardees helped improve safety for workers in mining, long-haul truck driving, carbon nanotubes and carbon nanofibers

manufacturing and use, and welding. To improve safety for miners, NIOSH scientists developed instructional software for the critical benching process of inspecting, assembling, and testing a Draeger BG 4 breathing apparatus and formulated best practices for using the material known as shotcrete to support underground mines. As a first step toward increasing safety for truck drivers and others on the road, the NIOSH National Survey of Long-haul Truck Drivers collected and analyzed critical data about drivers' safety attitudes and behavior. To protect workers who handle carbon nanotubes and nanofibers, NIOSH scientists visited worksites to measure adherence to the NIOSH recommended exposure limit. Finally, to improve safety among the country's welders, NIOSH scientists studied the influence of voltage on the composition of fumes and toxicity.

James P. Keogh Award

The James P. Keogh Award for Outstanding Service in Occupational Safety and Health recognizes a current or former employee of NIOSH whose career “exhibits respect and compassion for individual workers, with tireless leadership, courage, and a fierce determination to put knowledge into practice to enhance their well-being.” This year, NIOSH honored Dr. Thomas R. Waters for his pivotal research on work-related musculoskeletal disorders. During his distinguished 24-year career at NIOSH, Dr. Waters worked tirelessly to help protect underserved workers in manufacturing, retail, warehousing, and healthcare. In one of his major scientific contributions, Dr. Waters' research on the biomechanical demands of manual material handling led to the internationally used Revised NIOSH Lifting Equation. Today, health and safety professionals in industries worldwide use the equation as the basis for lifting standards.

Bullard-Sherwood Research-to-Practice Award

The Bullard-Sherwood Research-to-Practice Award, named for the inventor of the hard hat, Edward W. Bullard, and the inventor of the personal industrial hygiene sampling pump, R. Jeremy Sherwood, recognizes recipients for outstanding contributions in three categories: knowledge, interventions, and technology. This year's awards honored outstanding projects to increase worker protection in construction; healthcare and social assistance; and agriculture, forestry, and fishing. In the knowledge category, the National Construction Falls Prevention Campaign and Safety Stand-down took top honors as the first national, multilingual social marketing campaign to address the issues of falls among small residential construction contractors. In the interventions category, a project entitled Partnering with Industry to Build Safe EMS Work Environments received the award for efforts that led to improved crashworthiness of patient compartment components in ambulances. Finally, the project entitled Epidemiology and Engineering Safety for the Fishing Industry received the technology award for work that led to the development of an innovative personal flotation device.

Director's Award for Extraordinary Intramural Science

The Director's Award for Extraordinary Intramural Science recognizes outstanding collective contributions to science excellence at NIOSH by individual intramural scientists and support staff. Dr. Gayle DeBord, a recognized leader in her field of research pharmacology, received the Distinguished Career Scientist award for her groundbreaking work managing the Exposure Assessment Program. Under Dr. DeBord's leadership, an entirely new area—direct reading and sensor technology—developed and flourished. In addition, Dr. DeBord led a NIOSH effort to consider research on the occupational exposome, which is the term used to describe life-long exposure to all potentially harmful agents. Dr. Alysha Meyers received the Early Career Scientist award for her outstanding scientific contributions to the epidemiology of musculoskeletal disorders; ergonomics, Total Worker Health™, and the use of workers' compensation data for public health purposes. Barbara Cromer, a leading program operations assistant with 34 years of government service, received the Scientific Support award for providing critical administrative support and guidance for scientists in the NIOSH Education and Information Division.

Charles C. Shepard Award

Earlier this year, NIOSH announced its nominations for the Charles C. Shepard Award. Named for Charles C. Shepard, an internationally recognized microbiologist, this award is given in five categories, including the Lifetime Scientific Achievement Award. Dr. Cecil (Buzz) Burchfiel, a distinguished consultant in the Biostatistics and Epidemiology Branch in the Health Effects Laboratory Division, is the NIOSH nominee for the Charles C. Shepard Lifetime Scientific Achievement Award. Among Dr. Burchfiel's many accomplishments is one of the most successful and integrated research efforts to examine occupational stress and subclinical heart disease among police officers. In addition, NIOSH nominated nine papers for the other Charles C. Shepard Award categories: assessment, data methods and study design, laboratory science, and prevention and control.

For more information about the NIOSH Science Awards, including winners and nominees for all categories, go to the website, [CDC, NIOSH Scientific Awards](#).

For more information about NIOSH research activities, go to the website, [The National Institute for Occupational Safety and Health \(NIOSH\)](#).

Alice Hamilton Award for Occupational Safety and Health

The Alice Hamilton Award for Occupational Safety and Health recognizes the scientific excellence of technical and instructional materials by NIOSH scientists and engineers in the areas of biological science, engineering and physical science, human studies, and educational materials.

The award honors Dr. Alice Hamilton (1869–1970), a pioneering researcher and occupational physician, and it is presented each year by NIOSH on the basis of rigorous reviews by panels of scientific experts from outside the Institute.



Alice Hamilton, M.D.

(February 27, 1869–September 22, 1970)

Many of the first laws and regulations passed to improve the health of workers were the direct result of the work of one dedicated and talented woman, Alice Hamilton, M.D. Born into a prominent family in Indiana (her sister is the well-known classicist, Edith Hamilton), Dr. Hamilton graduated from medical school at the University of Michigan in 1893. After accepting a teaching position at the Women's Medical School of Northwestern University in 1897, she moved into Jane Addams' Hull House in Chicago. There she opened a well-baby clinic for poor families in the local settlement house neighborhood. As she acquainted herself with the families, she learned of their pains, strange deaths, lead palsy, "wrist drop," and of the high numbers of widowed women. Encouraged by the reformers of Hull House, she began to apply her medical knowledge to these social problems and thus began her scientific inquiry into occupational health for which she became known.

Dr. Hamilton quickly realized that while some progress in understanding occupational illness and disease was being made in Europe, little was written or understood about occupational disease conditions in the United States. In 1908, she published one of the first articles on occupational disease in this country and was soon a recognized expert on the topic. Starting in 1910, under the sponsorship initially of a commission of the state of Illinois, and later the Federal Bureau of Labor Statistics, she conducted a series of brilliant explorations of occupational toxic disorders. Relying primarily on "shoe leather epidemiology," and the emerging laboratory science of toxicology, she pioneered occupational epidemiology and industrial hygiene in the United States. Her findings were so scientifically persuasive that they caused sweeping reforms, both voluntary and regulatory, to improve the health of workers.

In 1919, Dr. Hamilton was appointed assistant professor of industrial medicine at Harvard Medical School and became the first female faculty member at Harvard University. There she served two terms on the Health Committee of the League of Nations. When she retired from Harvard at the age of 66, she became a consultant to the U.S. Division of Labor Standards, and she served as president of the National Consumers League.



Alice Hamilton Laboratory for Occupational Safety and Health

On Friday, February 27, 1987, the National Institute for Occupational Safety and Health dedicated its facility located at 5555 Ridge Avenue in Cincinnati, Ohio, to the memory of Alice Hamilton, M.D. The facility is known as the “Alice Hamilton Laboratory for Occupational Safety and Health” in honor of the first American physician to devote her professional life to the practice of occupational health.

Construction of this facility began in fall 1952 and was completed in November 1954. For several years, it was used as the world headquarters and manufacturing plant of the Disabled American Veterans. In this facility, “Ident-o-Tags,” miniature license plates for key chains, were manufactured by disabled veterans for distribution throughout the United States.

In the early 1960s, a portion of the facility was leased to the federal government to provide space for a small number of federal employees. From the early 1960s to the early 1970s more and more of the facility was used by the federal government, until by 1973, the entire building was leased for federal offices and laboratories. In September of 1974, the first employees of NIOSH were assigned space in the facility. In December 1982, the U.S. Public Health Service purchased the facility for \$3.5 million dollars. It now houses the Division of Physical Science and Engineering and the Division of Surveillance, Hazard Evaluations and Field Studies. More than 200 people work in engineering, epidemiology, general administration, industrial hygiene, and laboratory research. The facility contains some of the most advanced laboratories and sophisticated scientific equipment in the Institute.

Alice Hamilton Award Winners and Honorable Mentions

Education and Guidance

Winner

BG 4 benching trainer software: instructors' guide

Navoyski J, MacDonald B, Helfrich W, Brnich M, Mallet L, Beshero D, Roth P

NIOSH [2015]. BG 4 benching trainer software: instructors' guide. CD-ROM. By Navoyski J, MacDonald B, Helfrich W, Brnich M, Mallet L, Beshero D, Roth P. Pittsburgh, PA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2015-189c.

Abstract. The BG 4 Benching Trainer software, Version 1.0.5, is a supplemental tool used to assist mine rescue personnel in learning and retaining knowledge of the process of benching (inspecting, assembling, and testing) a Draeger BG 4 breathing apparatus. This interactive software, developed by researchers at the National Institute for Occupational Safety and Health (NIOSH), places the user in a 3D interactive environment where they can visually inspect the individual parts of a BG 4 breathing apparatus, assemble the parts, and test the assembled unit with the virtual RZ tester. The software provides three different training modes, which can be used by trainees learning about the apparatus and also by trainers using the software to teach. The Tutorial mode, useful for first-time users of the software, guides you through the interface and the different tools used to bench the virtual BG 4. The Intro to BG 4 mode allows users to bench a BG 4 without any flaws in the parts and at the user's own pace. The Quick Bench mode, designed for more experienced users, generates random flaws in the virtual BG 4 parts for the user to find prior to assembling and testing the apparatus. The Scenario Builder mode allows trainers to create custom scenarios for their trainees by preselecting flaws for various BG 4 parts. The *Instructor's Guide* (included with software) illustrates the flaws that can be found on the parts in the software. A *Quick Start Guide* and *Instructor's Guide* are included in the software.

Honorable Mention

Best practices: engineering controls, work practices, and exposure monitoring for occupational exposures to diacetyl and 2,3-pentanedione

Dunn KH, McKernan LT, Garcia A

NIOSH [2015]. Best practices: engineering controls, work practices, and exposure monitoring for occupational exposures to diacetyl and 2,3-pentanedione. Best practices. By Dunn KH, McKernan LT, Garcia A. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2015-197.

Abstract. Workers who handle diacetyl or work in areas where diacetyl exposure occurs are at risk of developing severe lung disease if their exposures are not properly controlled. The National Institute for Occupational Safety and Health (NIOSH) has developed guidance in a variety of areas to reduce workers' exposures to diacetyl through engineering controls, best work practices, and techniques for monitoring airborne diacetyl exposures. Although these guidelines emphasize diacetyl, they can be applied to reduce exposures to diacetyl substitutes such as 2,3-pentanedione and other alpha-diketones.

Engineering and Control

Winner

Shotcrete design and installation compliance testing: early strength, load capacity, toughness, adhesion strength, and applied quality

Martin LA, Clark CC, Seymour JB, Stepan MA

NIOSH [2015]. Shotcrete design and installation compliance testing: early strength, load capacity, toughness, adhesion strength, and applied quality. Report of investigations. By Martin LA, Clark CC, Seymour JB, Stepan MA. Spokane, WA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2015-107.

Abstract. The National Institute for Occupational Safety and Health (NIOSH) conducted a research study to document and develop safe practices for the use of shotcrete as ground support in underground mines, particularly in underground metal mines operating in weak host rock. Shotcrete is the generic name for a mixture of cement, sand, fine aggregate, and water that is applied pneumatically and compacted dynamically under high velocity. The objective of this research is to reduce mine worker fatalities and

injuries resulting from rockfall accidents. Although the information, techniques, and technology covered in this publication will impact both the mining and construction sectors, the primary audience is the mining industry with a focus on underground metal mines operating in weak ground conditions. The information and practices covered in this publication relating to the use of shotcrete can be put to use by mining professionals toward improving mine design and ground control plans. The guidance and practices reported in this document will help safety auditors, mining companies, and shotcrete suppliers in improving their shotcrete product specifications and the performance of ground support systems, evaluating ground control plans, and assessing shotcrete quality control. Ground control safety can be improved by providing these groups with a better understanding of the use of shotcrete in weak rock conditions, field test methods and equipment for measuring the strength properties of shotcrete directly at the mine site, and a practical means of conducting quality control during shotcrete applications.

Development of Portable Test Machines. NIOSH researchers developed three portable test machines for determining shotcrete strength properties directly at the mine site. These portable test machines can be used to measure the early-age compressive strength of the shotcrete, the flexural load capacity and toughness of the shotcrete, and the installed quality and bond strength of the shotcrete that is applied to underground entries; this enables the test machines to be used to verify safe re-entry times. Onsite testing of as-placed shotcrete allows the mine personnel and shotcrete supplier to determine if the shotcrete is performing to design specifications. Using these shotcrete test machines directly at a mine site allows the support capabilities of the shotcrete to be evaluated in terms of the specific ground conditions, support methods, mining spans, and entry dimensions at the mine. As a result, mine design decisions regarding the use of shotcrete can be made from a much more informed position. Ultimately, this enhanced onsite knowledge of shotcrete strength properties and the quality of shotcrete application techniques can result in better ground support system designs and procedures, thereby reducing the number of fatalities and injuries associated with groundfall accidents.

Shotcrete Characteristics and Application. When the shotcrete is applied in-cycle to underground mine surfaces as part of the ground support system, it becomes important to quantify when mining can safely resume under the material. As part of the overall ground support system, shotcrete is typically sprayed on the surface of an underground opening to stabilize the ground and prevent raveling. Shotcrete is also applied at lower water-to-cement ratios than concrete and develops its own unique strength characteristics. In addition, the quality of the applied shotcrete, the competency of the underlying rock, and the load-carrying capability of the shotcrete once cured are of critical importance. The significant shotcrete characteristics examined in this report are slump, compressive strength, tensile strength, early strength, adhesion strength, and flexural strength. Of these shotcrete characteristics the engineering strength properties that are determined using early strength, adhesion strength, and flexural strength testing methods are the focus of this report. To determine characteristics examined in this research study, the significant shotcrete tests were used: (1) Slump Test was used to

determine uncured (wet) shotcrete consistency, (2) Compression Test was used to measure cured shotcrete compression strength, (3) Tensile Test was used to measure cured shotcrete tensile strength, (4) Early Strength Partial-beam Test was used to measure shotcrete cure strength development over time, (5) Overcoring and Direct-tension Pull Test was used to measure cured shotcrete adhesion strength, and (6) Round Determinate Panel Flexure Test used to measure cured shotcrete load capacity and toughness.

Honorable Mention

Modeling and analysis of gas capture from sealed sections of abandoned coal mines

Karacan CÖ

Karacan CÖ [2015]. Modeling and analysis of gas capture from sealed sections of abandoned coal mines. *Int J Coal Geol* (138):30–41.

Abstract. All coal mines eventually complete their economic life, stop production, and are abandoned completely. Ventilation shafts and access drifts of these mines are usually sealed by plugging with concrete to isolate the mine environment from the outside atmosphere (surface) and also to prevent unauthorized access to old workings. Although large areas of access to the mine can be isolated, the void space left behind can never be isolated from surrounding coal and other formations. The void spaces act as a huge sink and start accumulating gas, perhaps groundwater as well, over time to form a methane reservoir. Understanding methane emission into old workings from surrounding strata, and the leakage characteristics of in-place mine seals, and analyzing gas production potential from such areas can improve ventilation designs in mines operating in similar settings, and can also enable the possibility of using abandoned mine methane (AMM) as an energy source. To meet these objectives, data acquired from different sources and utilized in the context of flow modeling and reservoir simulation, along with productions of AMM wells, can be invaluable tools. However, modeling of abandoned mines for gas emission and capture may not be an easy task. The difficulties in estimating spatial variability in various properties of the surrounding coal and mine environment, the complex geometry of the mine boundary and its details, and the initial conditions at the time of abandonment and when analysis begins all add to the challenge. In this paper, a reservoir modeling study that aims to characterize methane extraction from an abandoned room-and-pillar mine in the Springfield coal, Indiana, is demonstrated. The analyses related to interactions of surrounding coal with the abandoned mine environment were performed through history matching, initially, of two AMM wells drilled into two sealed sections. Analyses were then extended to evaluate different well locations to understand potential changes in gas emission from the coal, as well as leakage from the seals. Data required for establishing a detailed reservoir environment were obtained from mine maps, analysis of well productions by using a composite model, and by geostatistical modeling of point-wise data to create property maps. Results showed that wells drilled in larger sealed sections of the mine and away from previous workings

performed better. Furthermore, the location of the well in the sealed section can be important as locations close to surrounding coal can have a better chance of promoting more gas in-flow from the coal seam, whereas locations close to the seal can take advantage of leakage through the seal and can benefit from higher rates of the gas contributed from other parts of the mine. Since gas emissions from coal and leakage through seals vary with the pressure differential, simulations of AMM can also be used in ventilation design of mines operating in similar settings as estimates and thus can also help improving safety of mines with quantified understanding of leakage.

Honorable Mention

Resistance to synthetic blood penetration of National Institute for Occupational Safety and Health-approved N95 filtering facepiece respirators and surgical N95 respirators

Rengasamy S, Sbarra D, Nwoko J, Shaffer R

Rengasamy S, Sbarra D, Nwoko J, Shaffer R [2015]. Resistance to synthetic blood penetration of National Institute for Occupational Safety and Health-approved N95 filtering facepiece respirators and surgical N95 respirators. *Am J Infect Contr* 43(11):1190–1196.

Background. Surgical N95 filtering facepiece respirators (FFRs), certified by the National Institute for Occupational Safety and Health (NIOSH) as a respirator and cleared by the Food and Drug Administration (FDA) as a surgical mask, are often used to protect from the inhalation of infectious aerosols and from splashes/sprays of body fluids in health care facilities. A shortage of respirators can be expected during a pandemic. The availability of surgical N95 FFRs can potentially be increased by incorporating FDA clearance requirements in the NIOSH respirator approval process.

Methods. Fluid resistance of NIOSH-approved N95 FFRs and FDA-cleared surgical N95 FFRs and surgical masks was tested using the ASTM F1862 method at 450 and 635 cm/sec velocities and compared with the results from a third-party independent laboratory. Blood penetration through different layers of filter media of masks were also analyzed visually.

Results. Four N95 FFR models showed no test failures at both velocities. The penetration results obtained in the NIOSH laboratory were comparable to those from the third-party independent laboratory. The number of respirator samples failing the test increased with increasing test velocity.

Conclusions. The results indicate that several NIOSH-approved N95 FFR models would likely pass FDA clearance requirements for resistance to synthetic blood penetration.

Epidemiology and Surveillance

Winner

NIOSH National Survey of Long-haul Truck Drivers: injury and safety

Chen GX, Sieber WK, Lincoln JE, Birdsey J, Hitchcock EM, Nakata A, Robinson CF, Collins JW, Sweeney MH

Chen GX, Sieber WK, Lincoln JE, Birdsey J, Hitchcock EM, Nakata A, Robinson CF, Collins JW, Sweeney MH [2015]. NIOSH National Survey of Long-haul Truck Drivers: injury and safety. *Accid Anal Prev* 85:66–72.

Abstract. Approximately 1,701,500 people were employed as heavy and tractor-trailer truck drivers in the United States in 2012. The majority of them were long-haul truck drivers (LHTDs). There are limited data on occupational injury and safety in LHTDs, which prompted a targeted national survey. The National Institute of Occupational Safety and Health conducted a nationally representative survey of 1265 LHTDs at 32 truck stops across the contiguous United States in 2010. Data were collected on truck crashes, near misses, moving violations, work-related injuries, work environment, safety climate, driver training, job satisfaction, and driving behaviors. Results suggested that an estimated 2.6% of LHTDs reported a truck crash in 2010, 35% reported at least one crash while working as an LHTD, 24% reported at least one near miss in the previous 7 days, 17% reported at least one moving violation ticket, and 4.7% reported a non-crash injury involving days away from work in the previous 12 months. The majority (68%) of non-crash injuries among company drivers were not reported to employers. An estimate of 73% of LHTDs (16% often and 58% sometimes) perceived their delivery schedules unrealistically tight; 24% often continued driving despite fatigue, bad weather, or heavy traffic because they needed to deliver or pick up a load at a given time; 4.5% often drove 10 miles per hour or more over the speed limit; 6.0% never wore a seatbelt; 36% were often frustrated by other drivers on the road; 35% often had to wait for access to a loading dock; 37% reported being noncompliant with hours-of-service rules (10% often and 27% sometimes); 38% of LHTDs perceived their entry-level training inadequate; and 15% did not feel that safety of workers was a high priority with their management. This survey brings to light a number of important safety issues for further research and interventions, e.g., high prevalence of truck crashes, injury underreporting, unrealistically tight delivery schedules, noncompliance with hours-of-service rules, and inadequate entry-level training.

Honorable Mention

Trends of occupational fatalities involving machines, United States, 1992–2010

Marsh SM, Fosbroke DE

Marsh SM, Fosbroke DE [2015]. Trends of occupational fatalities involving machines, United States, 1992–2010. *Am J Ind Med* 58(11):1160–1173.

Background. This paper describes trends of occupational machine-related fatalities from 1992–2010. We examine temporal patterns by worker demographics, machine types (e.g., stationary, mobile), and industries.

Methods. We analyzed fatalities from Census of Fatal Occupational Injuries data provided by the Bureau of Labor Statistics to the National Institute for Occupational Safety and Health. We used injury source to identify machine-related incidents and Poisson regression to assess trends over the 19-year period.

Results. There was an average annual decrease of 2.8% in overall machine-related fatality rates from 1992 through 2010. Mobile machine-related fatality rates decreased an average of 2.6% annually and stationary machine-related rates decreased an average of 3.5% annually. Groups that continued to be at high risk included older workers, self-employed, and workers in agriculture/forestry/fishing, construction, and mining.

Conclusion. Addressing dangers posed by tractors, excavators, and other mobile machines needs to continue. High-risk worker groups should receive targeted information on machine safety.

Exposure and Risk Assessment

Winner

Carbon nanotube and nanofiber exposure assessments: an analysis of 14 site visits

Dahm MM, Schubauer-Berigan MK, Evans DE, Birch ME, Fernback JE, Deddens JA

Dahm MM, Schubauer-Berigan MK, Evans DE, Birch ME, Fernback JE, Deddens JA [2015]. Carbon nanotube and nanofiber exposure assessments: an analysis of 14 site visits. *Ann Occup Hyg* 59(6):705–723.

Abstract. Recent evidence has suggested the potential for wide-ranging health effects that could result from exposure to carbon nanotubes (CNT) and carbon nanofibers (CNF). In response, the National Institute for Occupational Safety and Health (NIOSH) set a recommended exposure limit (REL) for CNT and CNF: 1 microg m⁻³ as an 8-hour time weighted average (TWA) of elemental carbon (EC) for the respirable size fraction. The

purpose of this study was to conduct an industrywide exposure assessment among US CNT and CNF manufacturers and users. Fourteen total sites were visited to assess exposures to CNT (13 sites) and CNF (1 site). Personal breathing zone (PBZ) and area samples were collected for both the inhalable and respirable mass concentration of EC, using NIOSH Method 5040. Inhalable PBZ samples were collected at nine sites while at the remaining five sites both respirable and inhalable PBZ samples were collected side-by-side. Transmission electron microscopy (TEM) PBZ and area samples were also collected at the inhalable-size fraction and analyzed to quantify and size CNT and CNF agglomerate and fibrous exposures. Respirable EC PBZ concentrations ranged from 0.02 to 2.94 microg m⁻³ with a geometric mean (GM) of 0.34 microg m⁻³ and an 8-hour TWA of 0.16 microg m⁻³. PBZ samples at the inhalable-size fraction for EC ranged from 0.01 to 79.57 microg m⁻³ with a GM of 1.21 microg m⁻³. PBZ samples analyzed by TEM showed concentrations ranging from 0.0001 to 1.613 CNT or CNF-structures per cm³ with a GM of 0.008 and an 8-hour TWA concentration of 0.003. The most common CNT structure sizes were found to be larger agglomerates in the 2–5 microm range as well as agglomerates >5 microm. A statistically significant correlation was observed between the inhalable samples for the mass of EC and structure counts by TEM (Spearman $\rho = 0.39$, $P < 0.0001$). Overall, EC PBZ and area TWA samples were below the NIOSH REL (96% were <1 microg m⁻³ at the respirable-size fraction), while 30% of the inhalable PBZ EC samples were found to be >1 microg m⁻³. Until more information is known about health effects associated with larger agglomerates, it seems prudent to assess worker exposure to airborne CNT and CNF materials by monitoring EC at both the respirable and inhalable size fractions. Concurrent TEM samples should be collected to confirm the presence of CNT and CNF.

Honorable Mention

Laboratory and workplace assessments of rivet bucking bar vibration emissions

McDowell TW, Warren C, Xu XS, Welcome DE, Dong RG

McDowell TW, Warren C, Xu XS, Welcome DE, Dong RG [2015]. Laboratory and workplace assessments of rivet bucking bar vibration emissions. *Ann Occup Hyg* 59(3):382–397.

Abstract. Sheet metal workers operating rivet bucking bars are at risk of developing hand and wrist musculoskeletal disorders associated with exposures to hand-transmitted vibrations and forceful exertions required to operate these hand tools. New bucking bar technologies have been introduced in efforts to reduce workplace vibration exposures to these workers. However, the efficacy of these new bucking bar designs has not been well documented. While there are standardized laboratory-based methodologies for assessing the vibration emissions of many types of powered hand tools, no such standard exists for rivet bucking bars. Therefore, this study included the development of a laboratory-based method for assessing bucking bar vibrations that utilizes a simulated riveting task. With

this method, this study evaluated three traditional steel bucking bars, three similarly shaped tungsten alloy bars, and three bars featuring spring-dampeners. For comparison, the bucking bar vibrations were also assessed during three typical riveting tasks at a large aircraft maintenance facility. The bucking bars were rank-ordered in terms of unweighted and frequency-weighted acceleration measured at the hand-tool interface. The results suggest that the developed laboratory method is a reasonable technique for ranking bucking bar vibration emissions; the lab-based riveting simulations produced similar rankings to the workplace rankings. However, the laboratory-based acceleration averages were considerably lower than the workplace measurements. These observations suggest that the laboratory test results are acceptable for comparing and screening bucking bars, but the laboratory measurements should not be directly used for assessing the risk of workplace bucking bar vibration exposures. The newer bucking bar technologies exhibited significantly reduced vibrations compared to the traditional steel bars. The results of this study, together with other information such as rivet quality, productivity, tool weight, comfort, worker acceptance, and initial cost can be used to make informed bucking bar selections.

Methods and Laboratory Science

Winner

Modifying welding process parameters can reduce the neurotoxic potential of manganese-containing welding fumes

Sriram K, Lin GX, Jefferson AM, Stone S, Afshari A, Keane MJ, McKinney W, Jackson M, Chen BT, Schwegler-Berry D, Cumpston A, Cumpston JL, Roberts JR, Frazer DG, Antonini JM

Sriram K, Lin GX, Jefferson AM, Stone S, Afshari A, Keane MJ, McKinney W, Jackson M, Chen BT, Schwegler-Berry D, Cumpston A, Cumpston JL, Roberts JR, Frazer DG, Antonini JM [2015]. Modifying welding process parameters can reduce the neurotoxic potential of manganese-containing welding fumes. *Toxicology* 328:168–178.

Abstract. Welding fumes are a complex mixture of toxic metals and gases, inhalation of which can lead to adverse health effects among welders. The presence of manganese (Mn) in welding electrodes is cause for concern about the potential development of Parkinson's disease (PD)-like neurological disorder. Consequently, from an occupational safety perspective, there is a critical need to prevent adverse exposures to welding fumes. As the fume generation rate and physicochemical characteristics of welding aerosols are influenced by welding process parameters like voltage, current, or shielding gas, we sought to determine if changing such parameters can alter the fume profile and consequently its neurotoxic potential. Specifically, we evaluated the influence of voltage on fume composition and neurotoxic outcome. Rats were exposed by whole-body

inhalation (40mg/m³; 3h/day x 5 d/week x 2 weeks) to fumes generated by gas-metal arc welding using stainless steel electrodes (GMA-SS) at standard/regular voltage (25V; RVSS) or high voltage (30V; HVSS). Fumes generated under these conditions exhibited similar particulate morphology, appearing as chain-like aggregates; however, HVSS fumes comprised of a larger fraction of ultrafine particulates that are generally considered to be more toxic than their fine counterparts. Paradoxically, exposure to HVSS fumes did not elicit dopaminergic neurotoxicity, as monitored by the expression of dopaminergic and PD-related markers. We show that the lack of neurotoxicity is due to reduced solubility of Mn in HVSS fumes. Our findings show promise for process control procedures in developing prevention strategies for Mn-related neurotoxicity during welding; however, it warrants additional investigations to determine if such modifications can be suitably adapted at the workplace to avert or reduce adverse neurological risks.

Honorable Mention

Comparative dissolution of electrospun Al₂O₃ nanofibres in artificial human lung fluids

Shin HU, Stefaniak AB, Stojilovic N, Chase GG

Shin HU, Stefaniak AB, Stojilovic N, Chase GG [2015]. Comparative dissolution of electrospun Al₂O₃ nanofibres in artificial human lung fluids. *Environ Sci Nano* 2(3):251–261

Abstract. Sub-micron sized alumina fibres were fabricated by electrospinning and calcination of a polymer template fibre. In the calcination step, different controlled temperature heating cycles were conducted to obtain fibres of different crystalline structures. Their biodurabilities were tested at pH 7.4 with lung airway epithelial lining fluid or serum ultrafiltrate (SUF) and at pH 4.5 with macrophage phagolysosomal simulant fluid (PSF). Potential to generate free radicals was tested in vitro. Through the variation in the soak temperature from 650°C to 950°C (experiments S650–S950), the heating protocol affected the morphological characteristics, crystal structure, surface area, and density of the alumina fibres while their dissolution half-times were not significantly affected in SUF or PSF. Fibre samples formed at different heating ramp rates (experiments R93–R600) showed significant variation in the dissolution rates with the highest ramp rate corresponding to the highest dissolution rate. Thus, by increasing the calcination temperature ramp rate, the alumina fibres may be produced that have reduced biodurability and lower inflammogenic potential. The fibres with the highest dissolution rates had the least aluminium content. The solubility half-times of the alumina fibres were shortest for fibres calcined at the fastest temperature ramp rate (though soak temperature did not have an effect). The ramp rates also affected the aluminium content of the fibres, suggesting that the content may affect the structural strength of the fibres and control the dissolution.

Alice Hamilton Award Top Finalists

The names are not necessarily listed in the order in which they were ranked.

Education and Guidance

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NIOSH [2015]. Overlapping vulnerabilities: the occupational health and safety of young immigrant workers in small construction firms. Report. By Flynn MA, Cunningham TR, Guerin-RJ, Keller B, Chapman LJ, Hudson D, Salgado-C. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2015-178.

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Karacan CÖ [2015]. Modeling and analysis of gas capture from sealed sections of abandoned coal mines. *Int J Coal Geol* (138):30–41.

NIOSH [2015]. Shotcrete design and installation compliance testing: early strength, load capacity, toughness, adhesion strength, and applied quality. Report of investigations. By Martin LA, Clark CC, Seymour JB, Stepan MA. Spokane, WA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2015-107.

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Epidemiology and Surveillance

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Chen GX, Sieber WK, Lincoln JE, Birdsey J, Hitchcock EM, Nakata A, Robinson CF, Collins JW, Sweeney MH [2015]. NIOSH national survey of long-haul truck drivers: injury and safety. National survey. *Accid Anal Prev* 85:66–72.

Marsh SM, Fosbroke DE [2015]. Trends of occupational fatalities involving machines, United States, 1992–2010. *Am J Ind Med* 58(11):1160–1173.

Exposure and Risk Assessment

Dahm MM, Schubauer-Berigan MK, Evans DE, Birch ME, Fernback JE, Deddens JA [2015]. Carbon nanotube and nanofiber exposure assessments: an analysis of 14 site visits. *Ann Occup Hyg* 59(6):705–723.

Evans DE, Fent KW [2015]. Ultrafine and respirable particle exposure during vehicle fire suppression. *Environ Sci Process Impacts* 17(10):1749–1759.

McDowell TW, Warren C, Xu XS, Welcome DE, Dong RG [2015]. Laboratory and workplace assessments of rivet bucking bar vibration emissions. *Ann Occup Hyg* 59(3):382–397.

Methods and Laboratory Science

O'Callaghan JP, Kelly KA, Locker AR, Miller DB, Lasley SM [2015]. Corticosterone primes the neuroinflammatory response to DFP in mice: potential animal model of Gulf War Illness. *J Neurochem* 133(5):708–721.

Shin HU, Stefaniak AB, Stojilovic N, Chase GG [2015]. Comparative dissolution of electrospun Al₂O₃ nanofibres in artificial human lung fluids. *Environ Sci Nano* 2(3):251–261.

Sriram K, Lin GX, Jefferson AM, Stone S, Afshari A, Keane MJ, McKinney W, Jackson M, Chen BT, Schwegler-Berry D, Cumpston A, Cumpston JL, Roberts JR, Frazer DG, Antonini JM [2015]. Modifying welding process parameters can reduce the neurotoxic potential of manganese-containing welding fumes. *Toxicology* 328:168–178.

Alice Hamilton Award

Research Updates for 2015 Winning Projects

Education and Guidance 2015 Update

Ebola Interim Guidance Products

Bernard B, Brinker K, Berryann R, Boudreau Y, Brueck S, Burton N, Caruso C, Coca A, Cummings K, D'Alessandro M, Delaney L, de Perio M, Dowell C, Eisenberg J, Funk R, Jacklitsch B, Kiefer M, Kilinc-Balci FS, King B, Kim JH, MacMahon K, McKernan L, Methner M, Nickels L, Niemeier RT, Ridl S, Scharf T, Shaffer R, Shugart J, Williams W, Albrecht V, Arbury S, Arduino M, Bastian RK, Brown C, Coulliette A, Donlan R, Hodgson M, Klomp R, Matthews D, Noble-Wang J, Petitti C, Rose L, Shams A, Pickrel JM, Rhodes E, Rodgers M, Rotert K, Sayles G, Thomas R, Wang L

NIOSH [2014]. [Limiting heat burden while wearing personal protective equipment \(PPE\)—developed for healthcare workers and site coordinators providing care in West African countries affected by the Ebola outbreak](#). Slide presentation. By Jacklitsch B, Coca A, Eisenberg J, Kim JH, Methner M, Schaffer R, Shugart J, Williams W. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

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NIOSH [2014]. [Interim guidance for managers and workers handling untreated sewage from individuals with Ebola in the United States](#). Webpage. By Burton N, Shugart J, Arduino M, Donlan R, Albrecht V, Noble-Wang J, Rose L, Shams A, Bastian R, Pickrel JM, Rhodes E, Rodgers M, Rotert K, Sayles G, Wang L. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

NIOSH [2014]. [Frequently asked questions \(FAQs\) on interim guidance for managers and workers handling untreated sewage from suspected or confirmed individuals with Ebola in the U.S.](#) Webpage. By Donlan R, Burton N, Arduino M, Shugart J, Coulliette A, Albrecht V, Noble-Wang J, Rose L, Shams A, Bastian R, Pickrel JM, Rhodes E, Rodgers M, Rotert K, Sayles G, Wang L. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

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Update. The 2014–2015 Ebola epidemic is the largest in history, affecting countries in West Africa and outside Africa, including the United States, requiring an unprecedented public health response. The Ebola work products developed by NIOSH ensured occupational safety and health expertise and protection measures were included in both the domestic and international response. This allowed NIOSH to protect all types of workers who may have contact with Ebola virus. The NIOSH efforts also served to raise awareness about the important role occupational safety and health plays in public health emergencies.

This award included 15 Ebola work products that NIOSH directly developed. NIOSH continued to develop and revise guidance after this award period. For example, NIOSH developed *Guidance for Safe Handling of Human Remains of Ebola Patients in U.S. Hospitals and Mortuaries* and a companion job aid in response to requests from funeral home and mortuary professionals. This guidance was incorporated into domestic healthcare Ebola preparedness plans and used by CDC and local public health teams during on-site Ebola readiness assessments. When a death from Lassa fever was identified in the United States, these protocols were used to ensure the health and safety of workers handling the remains. Additionally, NIOSH staff played an integral role in updating CDC guidance on personal protective equipment (PPE) for healthcare workers to clarify the types of gowns and coveralls recommended to ensure the most appropriate PPE was used. Over the past year, several Ebola products required updating to reflect changes in the outbreak. For example, NIOSH staff revised the *Interim Guidance for U.S. Businesses, Employers, and Business Travelers to Prevent Exposures to Ebola* to reflect changes in international travel protocols.

The Ebola work products developed by NIOSH were incorporated by external partners into Ebola worker training programs across the country. We worked with the National Institute of Environmental Health Sciences (NIEHS) worker training grantees, who received Ebola supplemental funding, to assist them with incorporating NIOSH guidance in their Ebola training. Additionally, a special NIEHS Ebola request for applications was posted. This request emphasized the incorporation of NIOSH guidance in their training curriculum.

Since August 2014, these documents have had over 779,000 page visits and 12,000 downloads. As the countdown to declare this epidemic over is underway, we recently made the decision to archive the NIOSH Ebola Topic Page. Users can still access the materials but will see a disclaimer that the page is no longer being updated. NIOSH plans to revise the Ebola Topic Page and identify content appropriate for the page that is not specific to the 2014–2015 response. While many of the work products are event-specific, we recognize that they may have utility in future outbreaks and emergency responses. We will evaluate our Ebola work products that were part of this award and determine if it would be beneficial to adapt as generic guidance that would apply to future Ebola outbreaks or a broader emergency response.

Lastly, we would like to recognize that the process used during this response (including DLO involvement, clearance, inter-agency/CIO collaboration, and stakeholder input) to develop Ebola work products will serve as a model for how NIOSH will develop occupational health and safety documents and communication materials in future emergency responses. We are already following this process for the current Zika response.

Engineering and Control 2015 Update

Tool-specific performance of vibration-reducing gloves for attenuating palm-transmitted vibrations in three orthogonal directions

Dong R, Welcome D, Peterson D, Xu X, McDowell T, Warren C, Asaki T, Kudernatsch S., Brammer A

Dong R, Welcome D, Peterson D, Xu X, McDowell T, Warren C, Asaki T, Kudernatsch S., Brammer A [2014]. Tool-specific performance of vibration-reducing gloves for attenuating palm-transmitted vibrations in three orthogonal directions. *Int J Ind Ergon* 44:827–839.

Update. Prolonged, intensive exposure to hand-transmitted vibration is associated with hand-arm vibration syndrome (HAVS). It is estimated that more than 7 million workers in the United States are exposed to vibration from powered hand tools or handheld workpieces, based on the job data reported by the Bureau of Labor Statistics. These workers are primarily distributed in the construction, manufacturing, service, agriculture and forestry, transportation and wholesale, and mining sectors. It is also estimated that more than 1.4 million workers can be considered to be significantly exposed (daily

exposure for more than 1 hour). The prevalence of HAVS among the prolonged (>20 years) and intensively exposed population could be more than 50%.

One of the methods for reducing the hand-transmitted vibration exposure is the use of vibration-reducing (VR) gloves. If a VR glove passes the test criteria defined in ISO 10819, it is classified as anti-vibration (AV) gloves. Unfortunately, the VR or AV gloves are generally not as effective as ear plugs for noise reduction. The certified AV gloves do not guarantee they can reduce the hand-transmitted vibration when used with specific tools or handheld workpieces. AV gloves may not be as effective as some VR gloves that do not meet all the ISO-defined criteria. Their effectiveness is tool-specific. While it is technically difficult, time-consuming, and expensive to find the effectiveness of each VR glove for various tools through numerous experiments at workplaces, the study described in the Alice Hamilton Award winning paper used an innovative 3D transfer function method to estimate the effectiveness of typical VR gloves for reducing the vibration transmitted to the palm of the hand when used with various types of tools. The tool-specific effectiveness data of the gloves can be used to help conduct preliminary selection of the VR gloves when used with a tool.

Since this paper was published, NIOSH authors received several consultation requests. As the paper only described the glove effectiveness at the palm of the hand, a follow-up study has been conducted to estimate the glove effectiveness at the fingers of the hand. The findings of this study have been presented at a conference. A manuscript of this study has also been submitted to a journal and it is likely to be published soon. Considering the usefulness of the study, a senior researcher from the U.K. Health Safety Executive invited the major authors of the Alice Hamilton Award winning paper to join the effort to write two other papers on the appropriate evaluation and application of the VR gloves. One of these papers has been published and the other one will be published soon (Hewitt, Dong, Welcome, McDowell, 2015; in press). These authors are in the process of developing a general guidance on the selection and application of the VR gloves.

Epidemiology and Surveillance 2015 Update

Obesity and other risk factors: the National Survey of U.S. Long-Haul Truck Driver Health and Injury.

Sieber W, Robinson C, Birdsey J, Chen G, Hitchcock E, Lincoln J, Nakata A, Sweeney M

Sieber W, Robinson C, Birdsey J, Chen G, Hitchcock E, Lincoln J, Nakata A, Sweeney M [2014]. Obesity and other risk factors: the National Survey of U.S. Long-haul Truck Driver Health and Injury. *Am J Ind Med* 57(6):615–626.

Update. The Truck Transportation industry delivers cargo over-the-road transportation throughout the United States. In 2012, this was the largest subsector within the U.S. Transportation and Warehousing sector, employing 31% of all workers in the sector and transporting 71% of total weight of all shipments (valued at 17.4 billion dollars). Drivers of heavy and tractor trailer trucks made up the largest percentage (63%) of production

and nonsupervisory workers in truck transportation. Truck drivers have been reported to be at an increased risk for a number of chronic diseases and health conditions such as heart disease, diabetes mellitus, hypertension, and obesity. Drivers also experience high rates of injury. Beyond the economic impact of freight delivered by truck, safety of commercial motor vehicle crashes is a recognized national problem. Costs of commercial motor vehicle crashes in 2011 have been estimated at \$87 billion.

The 2015 Alice Hamilton Award winning paper described an innovative national survey that collected data from a nationally representative sample of long-haul truck drivers, allowing researchers to estimate the prevalence of health conditions, injuries, and risk factors among these workers. Several trucking companies and an insurance company have used the findings to justify health and wellness programs. The survey has also stimulated further research into working conditions and health conditions among drivers and has served as a model for similar survey efforts overseas in Canada and China. The March 2015 of *CDC Vital Signs*, “Trucker Safety: Using a Seat Belt Matters,” highlighted some of the paper’s findings. Findings have informed the U.S. Department of Transportation in various rule-making efforts and have provided input to a National Academies of Sciences review panel to investigate research methods and statistical approaches for understanding driver fatigue in motor carrier safety and driver health. Continuing work includes the following: (1) analysis of the sleep and fatigue data collected during the survey, (2) examination of the working and living conditions available to truck drivers at the truck stops they visit while delivering freight, (3) testing methods to collect health and fatigue data in this mobile and difficult-to-study worker population, and (4) testing methods for dissemination of health information to truck drivers.

Aside from the Alice Hamilton Award, the research team was a NIOSH nominee for the 2015 Charles C. Shepard Outstanding Scientific Paper Award. Since the Alice Hamilton Award, the following related works have been presented or published:

Birdsey J, Sieber WK, Chen G-X, Hitchcock EM, Lincoln JE, Nakata A, Robinson CF, Sweeney MH [2015]. National Survey of U.S. Long-haul Truck Driver Health and Injury: health behaviors. *J Occup Environ Med* 57(2):210–216.

Chen G-X, Sieber WK, Lincoln JE, Birdsey J, Hitchcock EM, Nakata A, Robinson CF, Collins JW, Sweeney MH [2015]. NIOSH National Survey of Long-haul Truck drivers: injury and safety. *Accid Anal Prev* 85:66–72.

Chen G-X, Collins JW, Sieber WK, Pratt SG, Rodriguez-Acosta RL, Lincoln JE, Birdsey J, Hitchcock EM, Robinson CF [2015]. Seat belt use among long-haul truck drivers—United States, 2010. *MMWR* 64(8)1–5.

Sieber WK, Llamas A [2015]. Long-haul truck drivers: obesity can take you off the road. Infographic. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

Sieber WK, Llamas A, Sweeney MH [2015]. Workplace safety and health topic: long-haul truck drivers. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

Exposure and Risk Assessment 2015 Update

Evaluation of some potential chemical exposure risks during flowback operations in unconventional oil and gas extraction: preliminary results

Esswein EJ, Snawder J, King B, Breitenstein M, Alexander-Scott M, Kiefer M

Esswein EJ, Snawder J, King B, Breitenstein M, Alexander-Scott M, Kiefer M [2014]. [Evaluation of some potential chemical exposure risks during flowback operations in unconventional oil and gas extraction: preliminary results](#). *J Occup Environ Hyg* 11(10):D174–D184.

Update. Field-based exposure assessment research continued in 2015. Sites visits were made to oil and gas extraction sites in Arkansas, Colorado, Louisiana, Pennsylvania, and West Virginia during March–September 2015.

A manuscript has been written and is being finalized describing 104 mostly full-shift measurements made for diesel particulate matter at a variety of drilling, completions, and servicing operations sites.

A book chapter entitled “Occupational Health and Safety Aspects of Oil and Gas Extraction” was written and has been published. The book is entitled *Environmental and Health Issues in Unconventional Oil and Gas Development*, and the publisher is Elsevier.

More than 10 invited presentations were made at conferences and meetings across the United States to discuss the research.

A NIOSH/OSHA Hazard Alert was written on the risks for chemical exposures during tank gauging operations and the nine deaths associated with the practice of tank gauging. Anticipated electronic publication is expected to be published in March 2016.

Methods and Laboratory Science 2015 Update

Lung epithelial cells resist influenza A infection by inducing the expression of cytochrome c oxidase VIc, which is modulated by miRNA 4276

Othumpangat S, Noti JD, Beezhold DH

Othumpangat S, Noti JD, Beezhold DH [2014]. Lung epithelial cells resist influenza A infection by inducing the expression of cytochrome c oxidase VIc which is modulated by miRNA 4276. *Virology* 468–470:256–264.

Update. After receiving the Alice Hamilton Award, we continued our studies on miRNAs induced by influenza virus and explored for additional miRNAs that may be biomarkers for the early detection of influenza infection. We employed next generation sequencing (NGS) analysis to identify differentially expressed miRNAs in cells infected with either an aerosol or non-aerosol transmitted influenza virus. NGS libraries were prepared, alignment and downstream analyses were carried out, and a subset of known miRNAs that had significantly different expression levels in cells infected with the aerosol (IP10) vs non-aerosol(IWF10) transmitted virus was identified. Fifty known miRNAs were selected that had the largest variation in levels across all the samples. The miRNAs that showed the highest expression in IWF10 compared to IP10 were miR-25, miR-26 and miR-378. Additionally, forty putative novel miRNAs showed significant differential expression. Novel miRNAs in all the samples were predicted from their sequences, as they do not map to any organism found in miRbase or to any other known RNA sequences. These dysregulated microRNAs may have a role in influenza pathogenesis and are currently undergoing verification.

One key transcription factor activated upon influenza infection is NF- κ B. One mechanism of regulation of NF- κ B involves inhibitor proteins that form complexes with NF- κ B and thereby sequester it into the cytoplasm. This effectively prevents nuclear translocation of NF- κ B and subsequent transcription of its target genes. We identified miR-4776, which is upregulated in response to influenza infection and targets NF κ BIB, thereby modulating NF- κ B activity. The miR-4776 is upregulated in A549 cells following exposure to influenza virus, compared to uninfected control cells. The increase in miR-4776 correlated with the subsequent decrease in NF κ BIB mRNA and subsequent increase in NF- κ B.

We have begun a clinical study to collect blood samples from flu patients (Jan–March 2016) and plan to evaluate the miRNA profile in serum and exosomes to identify potential markers of influenza infection. We will be particularly interested in knowing whether any of the miRNAs we have already identified are present in serum and exosomes.

Papers published:

Othumpangat S, Noti JD, McMillen CM, Beezhold DH [2016]. ICAM1 regulates the survival of influenza virus in lung epithelial cells during the early stages of infection. *Virology* 487:85–94.

Lindsley WG, Noti JD, Blachere FM, Thewalis RE, Martin SB, Othumpangat S, Noorbaksh B, Goldsmith WT, Vishnu A, Palmer JE, Clark KE, Beezhold DH [2015]. Viable influenza A virus in airborne particles from human coughs. *J Occup Environ Hyg* 12:107–113.

Lindsley WG, Blachere FM, Beezhold DH, Thewlis R, Noorbaksh B, Othumpangat S, Goldsmith WT, McMillen CM, Andrew ME, Burrell CN, Noti JD [2016]. Viable influenza virus in airborne particles expelled during coughs vs exhalations. *Influenza Other Respir Viruses*. Advanced online publication.

Papers Presented:

Othumpangat S, Noti JD, Beezhold DH [2015]. ICAM-1 alters the survival of influenza virus in lung airway epithelial cells and is regulated by miRNA-4514. *Keystone Symposia on Molecular and Cellular Biology: MicroRNAs and Noncoding RNAs in Cancer*, Keystone, CO, June 7–12.

Noti JD, Bryan NB, Othumpangat S, Blachere FM, Noorbakhsh B, Khakoo R, Lindsley WG, Beezhold DH [2015]. Influenza virus regulates NF- κ B activation by a coordinated induction of multiple miRNAs acting on NF- κ B protein. *Keystone Symposia on Molecular and Cellular Biology: MicroRNAs and Noncoding RNAs in Cancer*, Keystone, CO, June 7–12.

Lindsley WG, Blachere FM, Beezhold DH, Thewlis R, Noorbakhsh B, Othumpangat S, Goldsmith W, McMillen CM, Burrell CN, Noti JD [2015]. Viable influenza virus in cough and exhaled breath aerosol particles. *AAAR 34th Annual Conference*, Minneapolis, MN, October 12–16.

Bryan NB, Othumpangat S, Noti JD, Khakoo R [2015]. NF- κ B activation is modulated via induction of microRNA 4776 acting on NF- κ B following infection with influenza H1N1 in bronchial epithelial cells. *IDS meeting*, San Diego, CA, October 10–15.

Book Chapter:

Othumpangat S, Noti JD, Ray SD [2015]. Antiviral drugs. In: Ray SD, ed. *Side effects of drugs annual*. Vol 37. Elsevier publisher, 329–348.

Bullard-Sherwood Research-to-Practice (r2p) Award

NIOSH presents the Bullard-Sherwood Research-to-Practice (r2p) Award to recognize outstanding efforts by its scientists and their partners in applying occupational safety and health research to prevent work-related injury, illness, and death. The award is named in honor of two distinguished individuals who have made significant improvements in workplace injury and illness prevention.



Edward W. Bullard

Edward W. Bullard designed the first “hard hat” as protective headgear for miners. He combined his experience with doughboy Army helmets during World War I and his understanding of customer needs to develop the “Hard Boiled Hat.” The name was derived from the use of steam during the hat manufacturing process. Joseph Strauss, the engineer in charge of constructing the Golden Gate Bridge, requested that Mr. Bullard adapt his mineworker helmet to help protect bridge workers from falling rivets. The bridge site became the first designated “Hard Hat Construction Area.” In related history, the steel used in the building of the bridge oxidized during transport to San Francisco from Pennsylvania, and it therefore required sandblasting before it could be painted. As a result, Mr. Bullard designed and sold another helmet to the bridge builders to specifically protect the sandblasting workers. This helmet was similar to the Hard Boiled Hat, but it included in its design a hood or “canopy” over the hat, a window to see through, and supplied air for respiratory protection. Today, approximately 6 million hard hats are sold annually throughout the world to protect workers. Bullard’s family-owned company, now entering its fifth generation, still produces many of those hard hats, as well as more modern sandblasting helmets.

R. Jeremy (Jerry) Sherwood

R. Jeremy (Jerry) Sherwood successfully merged research and industrial hygiene by inventing the first practical personal sampling pump in the late 1950s. He identified a need for sampling pumps that could be worn by workers and not impede their work processes. Until then, sampling was done on an area basis, or an industrial hygienist followed a worker while carrying heavy, bulky, and short-term sampling equipment. Using the newly developed personal sampling pump, he demonstrated that area sampling often severely underestimated worker exposures. Within a few years of this invention, personal sampling pumps became the staple in industrial hygiene work that they are today. He also developed a miniature sampler for sulfur dioxide that became commercially available and was widely used throughout Europe. His research on respirators led to the first fit testing. While at the International Labour Organization and

later at the World Health Organization, Mr. Sherwood put his own knowledge and research experiences into practice by training others in occupational safety and health, particularly in developing countries. This became one of his greatest passions, and many workers around the world have benefitted from his efforts.

Bullard-Sherwood Research-to-Practice (r2p) Award Winners and Honorable Mentions

Knowledge

Winner

The National Construction Falls Prevention Campaign and Safety Stand-down

Branche C, Check P, Spring C, Sadeghpour N, Filko A, Blosser F, Gillen M, Earnest GS, Garza E, Taylor J, Pan C, Bobick T, Romano N, Stafford P, Trahan C, Betit E, Bunting J, Watters M, Sinyai C, Maddux J, Meilinger F, McKenzie D, Berkowitz D, NORA Construction Sector Council

Source: Office of the Director (OD)

Background: In the United States, the construction industry employs nearly ten million workers. Construction workers are more likely to die on the job than workers in any other industry. Many construction occupations require working at heights and climbing ladders or scaffolds on a daily basis. Each year, more than 200 construction workers are killed and over 10,000 are seriously injured by falls [CPWR 2014]. Falls in construction are preventable, but remain problematic, especially among small residential construction contractors who commonly lack resources for safety personnel.

Relevance: NIOSH and the NORA Construction Sector Council collaborated with The Center for Construction Research and Training (CPWR) and the Occupational Safety and Health Administration (OSHA) to develop Safety Pays, Falls Cost, the first national multilingual social marketing campaign to address the issues of falls from ladders, roofs, and scaffolds among small residential construction contractors. Safety Pays, Falls Cost encourages residential construction contractors to (1) plan ahead to get the job done safely, (2) provide the right equipment, and (3) train everyone to use the equipment safely.

Since campaign kick-off on Workers' Memorial Day in 2012, Safety Pays, Falls Cost has increased in size, scope, and impact every year. The Safety Pays, Falls Cost campaign website, www.stopconstructionfalls.com hosted by CPWR, has received over 200,000 visits. Starting in 2014, OSHA has hosted an annual National Construction Safety Stand-down, a voluntary event for employers to talk directly to employees about safety, fall hazards, and protective methods. The National Stand-down effort is estimated to have

reached over 1.5 million people. During its first year, 4,882 employers and other organizations voluntarily notified OSHA of their participation. Through these organizations, 770,193 individuals participated in stand-down activities, such as conducting trainings and inspecting equipment.

The NORA Construction Sector Council, which includes federal and state agencies, employer organizations, universities, and professional organizations, led campaign activities rooted in research methods. They conducted an environmental scan, focus groups, and evaluations to shape and improve the campaign. The Sector Council also substantially contributed to supporting research, campaign educational resources, and social media outreach. Safety Pays, Falls Cost and the Stand-down serve as a platform to promote NIOSH-developed fall prevention solutions, such as the Ladder Safety application and a patented guardrail system.

Partnerships have been instrumental to the campaign's success and its many moving parts. The campaign provides resources organized in a centralized location, making it easier for small residential contractors to access helpful safety information. The third Safety Stand-down is May 2–6, 2016.

More information about the National Construction Falls Prevention Campaign and Safety Stand-down and other construction-related topics can be found at the following websites:

- [Stop Construction Falls](#)
- [Construction Safety and Health](#)

Reference

CPWR [2014]. Safety pays. Falls cost. Silver Spring, MD: Center for Construction Research and Training, <http://stopconstructionfalls.com/>.

Intervention

Winner

Partnering with Industry to Build Safe EMS Work Environments

Green JD, Spata SC

Source: Division of Safety Research (DSR)

Background: Fast-pace, intense, and mobile characterize the work environment of emergency medical services (EMS) workers. In 2011, an estimated 27,800 injuries and illnesses among EMS workers were treated in U.S. hospital emergency departments [NIOSH 2014]. During emergency transport of patients, EMS workers are at risk of vehicle crash-related injuries and fatalities. Prior NIOSH research, as well as National Highway Traffic Safety Administration and NIOSH crash investigations, identified seating, occupant restraints, the patient cot, and loose medical equipment as key risk

factors contributing to EMS worker fatality rates that exceed the general worker population by a factor of three.

Relevance: Recognizing that ambulances fall outside most federal crash safety regulations, during the period from 2011 through 2015, NIOSH and the National Truck Equipment Association co-chaired ten ambulance-component-specific committees to develop a family of crash test methods. These test methods, now published by the Society of Automotive Engineers (SAE), improved the crashworthiness of ambulance patient compartment components such as worker seating, the patient cot, equipment mounts, and the ambulance body structure.

During test methodology development, manufacturers partnered with NIOSH to redesign and test new products to meet the proposed requirements. Many partners initially chose to test existing hardware, often with less-than-optimal results. By the completion of this effort, all industry partners had produced and tested new crashworthy products that met the performance requirements delineated by SAE. In addition, each industry partner moved forward, manufactured these new crashworthy products, and made them commercially available prior to the adoption of the new test methods by a single state.

NIOSH then successfully acted as the primary liaison to ensure the SAE published test methods were incorporated into each of three bump-to-bump national standards or specifications. On July 1, 2015, the General Services Administration (GSA) adopted the new crashworthy test methods into their Star-of-Life Ambulance Specification (KKK-A-1822F). Thirty states previously adopted the GSA Specification in their regulatory language; these states are also required to install new components, tested to the new NIOSH-generated SAE test methods, in all new ambulances ordered after July 1, 2015. Products not tested are no longer available in these states. Remaining states are considering adoption of the GSA Specification, NFPA's 1917 Ground Ambulance Standard, and the CAAS Ground Vehicle Standard (CAAS GVS 2016), all of which include these new test methods.

Partnerships developed early and maintained throughout the project accelerated the introduction of new products into the market, thus improving worker safety. The team is now working with the National Association for State EMS Officials to increase adoption of these test methods by all 50 states and five U.S. territories through a joint educational campaign.

More information about emergency medical service-related topics can be found at the following websites:

- [Partnering with Industry to Build Safe EMS Work Environments](#)
- [Emergency Medical Services Workers](#)

Reference

NIOSH [2014]. Emergency medical services workers. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention,

National Institute for Occupational Safety and Health,
<http://www.cdc.gov/niosh/topics/ems/default.html>.

Honorable Mention

Partnership to Increase Health Equity among Spanish-speaking Immigrant Workers (Consulates)

Flynn MA, Check P, Filko A, Sadeghpour N

Source: Education and Information Division (EID)

Background: About 18 million Latino immigrants live in the United States [Batalova and Terrazas 2010]. They have a workplace fatality rate of 5.9 per 100,000, which is almost 50% higher than the rate for all workers [Cierpich 2008]. Workplace safety training is critical, but immigrant workers frequently report not receiving any job safety training or receiving poor quality training. Language barriers, cultural differences, and social structures are also challenges. Stakeholders and partners such as the U.S.-Mexico Border Health Commission and the Mexican consulates sought assistance from NIOSH to address these issues.

Relevance: NIOSH worked with Ventanillas de Salud, the Mexican Foreign Ministry's health promotion program for its U.S. diaspora, serving more than one million people, and with experts from academia, organized labor, and trade associations. This collaboration led to a key partnership with the Mexican consulates and the development of highly-tailored educational materials. NIOSH is now represented on the National Advisory Board for the Ventanillas de Salud program. Pamphlets, videos, and posters were created to raise awareness among Spanish-speaking immigrant workers about occupational safety and health (OSH) issues and to provide tools and motivation for those workers to seek additional information and assistance.

The first month of a campaign targeting organizations that work with Spanish-speaking immigrant workers resulted in more than 1,000 brochure and poster downloads and more than 1,000 video views. Time spent on both the English and Spanish landing pages was above average for NIOSH pages, and a few thousand visitors delved deeper into the additional materials.

OSH is now one of the five priority topics for health promotion activities conducted in Mexican consulates across the United States. All 50 consulates are distributing the NIOSH-developed materials. The Mexican Ministry of Government, U.S. Embassy in Mexico, OSHA, and several community-based organizations have also expressed interest in distributing the materials.

The increased institutional support for OSH in Mexican consulates, given their significant profile in immigrant communities, will likely lead to a heightened awareness of OSH-related issues among immigrants and the organizations that serve them, including governments from other Latin American countries. This project has generated

interest in OSH and immigration among other Mexican Ministries, particularly around improving surveillance. Finally, the partnership and materials-development process provide a model for how to reach this population in an appropriate and effective way and establishes an institutional conduit for OSHA and immigrant organizations to collaborate better.

More information about this campaign and immigrant work-related topics can be found at the following website:

- [Protect Yourself at Work \(Protégase en el Trabajo\)](#)

References

Batalova J, Terrazas A. [2010]. Frequently requested statistics on immigrants and immigration in the U.S. Migration Information Source, www.migrationinformation.org/feature/display.cfm?ID=818#2.

Cierpich H, Styles L, Harrison R, et al. [2008]. Work-related injury deaths among Hispanics-United States, 1992-2006. *Journal of the American Medical Association*, 300(21), 2479–2480.

Technology

Winner

Epidemiology and Engineering Safety for the Fishing Industry

Lincoln JM, Lucas DL, Teske TD, Woodward C, King G, Forrester C, Bond CC, Cermak J

Source: Western States Division (WSD)

Background: Commercial fishing is generally identified as the most dangerous occupation worldwide, with a rough estimate of 24,000 work-related deaths per year according to the Food and Agriculture Organization. In the United States, the commercial fishing work-related fatality rate is 23 times the rate for all workers. Eighty-six percent of fatalities are caused by drowning after a vessel disaster or a fall overboard. Although the risk of drowning is high, most deckhands do not wear personal flotation devices (PFDs) while working on deck. Currently, regulatory agencies do not mandate that workers wear PFDs.

Relevance: A past NIOSH study found that workers had low PFD use if they believed PFDs interfered with work, were an entanglement hazard, or felt uncomfortable. NIOSH recommended that manufacturers collaborate with workers in the design and promotion of more comfortable PFDs. Throughout the PFD study, NIOSH actively engaged PFD manufacturers to improve understanding of the PFD market. This broad network proved to be a valuable pathway for sharing research findings with manufacturer representatives.

In response to the dissemination efforts, a new PFD manufacturer, Kent Safety Products, approached NIOSH about a potential partnership. NIOSH provided study design details

and raw data, including direct comments regarding fishermen's PFD preferences, and discussed next steps toward the development of an innovative PFD. In accordance with NIOSH recommendations, the manufacturer engaged fishermen in the development process, collecting additional preference data from fishermen on other PFD models. As a result, Kent Safety Products designed and manufactured an innovative "tactical deck vest." After a series of field tests and adjustments, the final product was released to the commercial market in late November 2014 and subsequently won the 2014 Fisheries Supply Innovation Award (Safety Category).

According to the manufacturer, the product launch was very successful. Sales figures demonstrated a high rate of initial acceptance of the PFD in the workplace. In the first year, over 2,000 units were sold. About 80% of those sales were to fishermen in the Pacific Northwest. More would have been sold, but the manufacturers ran out of smaller sizes almost immediately.

Kent Safety Products continued to build upon the innovative PFD design. They revealed a new PFD prototype featuring a new high visibility design and lighter weight form at the 2015 Pacific Marine Expo. Kent Safety Products offers the original model along with the new model, thus providing options to meet the varied preferences of commercial fishermen. Ultimately, if fishermen perceive that a PFD model alleviates comfort and safety concerns, more may choose to wear PFDs and fewer lives will be lost.

More information about PFDs and commercial fishing-related topics can be found at the following websites:

- [Personal Flotation Devices \(PFDs\)](#)
- [Live to be Salty](#)
- [Commercial Fishing Safety](#)

Bullard-Sherwood Research-to-Practice (r2p) Award Top Finalists

Projects are listed by category, alphabetically by the last names of project officers. Order of listing does not necessarily reflect the order in which the projects were ranked.

Knowledge

The National Construction Falls Prevention Campaign and Safety Stand-down

Branche C, Check P, Spring C, Sadeghpour N, Filko A, Blosser F, Gillen M, Earnest GS, Garza E, Taylor J, Pan C, Bobick T, Romano N, Stafford P, Trahan C, Betit E, Bunting J, Watters M, Sinyai C, Maddux J, Meilinger F, McKenzie D, Berkowitz D, NORA Construction Sector Council

Safety Matters: A Safety & Health Training for Young Workers

Guerin RJ, Okun AH, Romero N, Baker DS, Fazio G, Leonard SR, Storms C, Hornback DA, White TJ, Tienken B

Motor-Vehicle Safety of Law Enforcement Officers

Tiesman HM, Heick R

Intervention

Partnership to Increase Health Equity among Spanish-speaking Immigrant Workers (Consulates)

Flynn MA, Check P, Filko A, Sadeghpour N

Partnering with Industry to Build Safe EMS Work Environments

Green JD, Spata SC

Evaluation of Workplace Violence Safety Ordinances for Taxi Drivers

Menéndez CC, Zeng S, Amandus H, Amendola A, Hendricks S, Konda S, Damadi P, Wu N, Current RS, Newbraugh BH, Cantis DM, Weaver D

Technology

Engineering Noise Controls for Longwall Mining Systems

Camargo HE, Azman AS, Alcorn L

Epidemiology and Engineering Safety for the Fishing Industry

Lincoln JM, Lucas DL, Teske TD, Woodward C, King G, Forrester C, Bond CC, Cermak J

Improving Situational Awareness through Visual Interventions

Sammarco JJ, Matty T, Mayton A, Steiner L

Previous Bullard-Sherwood Research-to-Practice (r2p) Award Winners and Honorable Mentions

View the previous [Bullard-Sherwood Research-to-Practice \(r2p\) Award Winners and Honorable Mentions](#).

Director's Intramural Award for Extraordinary Science (DIA)

Science excellence is the foundation upon which NIOSH generates new knowledge to assure safe and healthful work for all. The purpose of the Director's Intramural Award for Extraordinary Science (DIA) is to recognize outstanding contributions by intramural scientists and support staff to science excellence at NIOSH. Winners of the NIOSH Director's Intramural Award for Extraordinary Science (DIA) will receive a monetary award that augments the discretionary budget for the recipient for the following fiscal year.

Winners will also receive recognition at the annual ceremony celebrating the Alice Hamilton Award for Excellence in Occupational Safety and Health.



The CDC-wide Charles C. Shepard Science Award and the NIOSH Alice Hamilton and Bullard-Sherwood Research-to-Practice Award recognize the scientific contributions of a single research project or activity. The Director's Intramural Award for Extraordinary Science (DIA) honors individuals for their scientific contributions through a collective body of work. Although the James P. Keogh Award also recognizes a collective body of work, it is more oriented toward service than science as it focuses on dedicated service, training, and research translation to achieve tangible effects on public health practice. The collective body of work recognized in the Director's Intramural Award for Extraordinary Science (DIA) represents extraordinary individual performance that clearly goes above and beyond past and present basic job requirements.

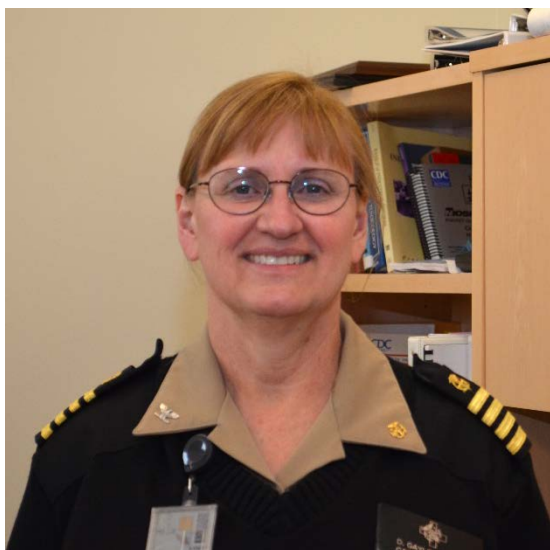
The Director's Intramural Award serves as a tribute to NIOSH employees whose dedication to science excellence has made significant contributions to the NIOSH mission. Award categories will recognize experienced scientists, early career scientists, and scientific support staff.

Director's Intramural Award for Extraordinary Science (DIA)

Distinguished Career Scientist

Gayle DeBord, Ph.D

Dr. Gayle DeBord is the associate director for science for the Division of Applied Research and Technology of the National Institute for Occupational Safety and Health (NIOSH) in the Centers for Disease Control and Prevention (CDC). Dr. DeBord holds the rank of Captain in the Commissioned Corps of the U.S. Public Health Service. She began her work at NIOSH and the Public Health Service in 1987 as a research pharmacologist. As a result of her many research projects and collaborations, Dr. DeBord is the



primary author or co-author on more than 40 peer-reviewed publications, as well as NIOSH reports and other technical documents. She also has given numerous scientific presentations and invited addresses. Her work as the manager of the Exposure Assessment Program led to the development of an entirely new area—direct reading and sensor technology. This included the start of the new Center for Direct Reading Instruments, which has the mission to coordinate a national agenda for sensors, develop guidance documents pertinent to sensors such as validation and performance characteristics, and establish partnerships to advance the Center's goals. In the last few years, Dr. DeBord has led a NIOSH effort to consider research on the occupational exposome, a consideration of life-long exposure to all agents. While this work is only in its early stages, she has become the foremost NIOSH scientist on the topic and represents NIOSH in interagency work groups on the topic.

Early Career Scientist

Alysha Meyers, Ph.D., CPE

Dr. Alysha Meyers began her career at NIOSH as an Epidemic Intelligence Service Officer in 2010 and quickly became known for her strong work ethic, exacting attention to detail, and dedication to conducting quality scientific work. Dr. Meyers continues to demonstrate outstanding epidemiologic skills and the ability to work well both independently and collaboratively as an epidemiologist in Division of Surveillance, Hazard Evaluation, and Field Studies (DSHEFS). She has



authored or co-authored nine peer-reviewed journal articles and several government publications (e.g., MMWR, NIOSH numbered publications) and has become a subject matter expert in the epidemiology of musculoskeletal disorders, ergonomics, Total Worker Health™, and use of workers' compensation data for public health purposes. Dr. Meyers serves as lead epidemiologist on the Ohio Bureau of Workers' Compensation Occupational Safety and Health Study. She developed a novel method of auto-coding text data for millions of workers' compensation claims and co-led a team to develop and implement the approach. Dr. Meyers consistently provides high-quality scientific advice and guidance within the government and to outside entities such as academic institutions, state health departments, non-profits, international organizations, and the public.

Scientific Support

Barbara Cromer

Barbara Cromer started her government career in 1980 at the Cincinnati, Ohio, Veteran's Administration Medical Center. Ms. Cromer began her scientific support career for the National Institute for Occupational Safety and Health (NIOSH) in 1991. She has worked in the administrative field to support scientific staff throughout her NIOSH career. She has 34 years of government service.

In her position as the program operations assistant in the Technical Research and Evaluation Branch (TREB), Ms. Cromer has provided critical administrative support for TREB scientists, as well as others in the Education and Information Division (EID). As one example of the accuracy and quality of Ms. Cromer's work, in 2015 the TREB chief received five emails of praise from the Division program management official for Ms. Cromer's efforts in facilitating and coordinating the numerous administrative processes that supported TREB scientific staff activities. Her dependable and diligent work supported and improved the development and clearance processes for NIOSH scientific products, the travel of NIOSH scientists to conduct critical field data collection and participate in key scientific meetings, and the procurement processes that support ongoing research projects. She has been a mentor for other administrative professionals inside and outside of EID, which has expanded the reach and impact of her scientific support across the Institute.



Director's Intramural Award for Extraordinary Science (DIA) Top Finalists

The names are listed alphabetically, and not necessarily in the order in which they were ranked.

Scientific Support

James Addis

Barbara Cromer

Brian Tift

Early Career Scientist

Naomi Hudson

Alysha Meyers

Lincan Yan

Distinguished Career Scientist

Gayle DeBord

Eileen Kuempel

Stephanie Pratt

Director's Intramural Award for Extraordinary Science (DIA) Updates

Distinguished Career Scientist 2014

Mark R. Stephenson, Ph.D.

The current NIOSH hearing damage-risk criteria were published in 1998 and have been widely adopted by academia, industry, and governmental agencies. Over the years, the NIOSH “Criteria Document” (as it has come to be known) has been reviewed and endorsed many times – including 2006 and 2010 reviews by the National Academy of Medicine (then The Institute of Medicine) and the National Academy of Engineering, respectively. However, the 1998 Criteria Document only provided guidance and recommendations for workers exposed to continuous-type noises. At that time, the state-of-the-art was not sufficient for NIOSH scientists to promote criteria for exposures to non-Gaussian noise (e.g., impulsive noises and certain types of intermittent noise exposures).

In the ensuing years, advances in noise measurement technology made workplace measurement of non-Gaussian noise feasible, and hearing conservation researchers began to develop noise exposure databases which included worker exposures to non-Gaussian noise. With the emerging availability of new noise measurement capabilities and new databases, the NORA Hearing Loss Prevention Cross-Sector Strategic Plan incorporated new priority goals for updated hearing damage-risk criteria.

When Dr. Stephenson received the 2013 Director's Intramural Award for Extraordinary Science (Distinguished Career Scientist category) in the spring of 2014, he had about a year and a half until his planned retirement at the end of 2015. With this in mind, he applied the award funds towards a focused effort that could be largely completed by the time he retired. After consulting with Dr. Greg Lotz, Director of DART, a decision was made to combine the award funds with priority funds to initiate an additional effort that would be part of a larger program to develop updated NIOSH hearing damage-risk criteria.

In developing plans and programs for new NIOSH hearing damage-risk criteria, the NIOSH Hearing Loss Prevention Team adopted an approach similar to that which was used in developing the highly successful 1998 Criteria Document. Thus, it was again decided to conduct a comprehensive assessment of the available data and research associated with occupational hearing loss. This review would focus on (1) the effect of non-Gaussian noise, (2) determine which time-intensity exchange rate most accurately predicts the hearing hazard associated with complex noise exposure, and (3) assess the relationship between noise exposure and the subsequent development of hearing loss (including age-related hearing loss or presbycusis).

A contract to examine these three issues was awarded in September 2014. At the time of this writing a final report has just been received. A critical review of this report is currently underway, and a meeting among NIOSH research staff to discuss the findings is scheduled for the spring of 2016. Although it would be premature to draw firm conclusions, it is likely that the current findings will support the following:

1. Non-Gaussian noise may be more harmful than previously thought. However, based upon the increasingly widespread use of hearing protection, there is an increasingly narrow window within which additional data from occupational exposure of humans will be available.
2. The 3-dB exchange rate will need to be modified by some value which accounts for kurtosis in order to accurately predict the hearing damage-risk associated with many common occupational noise exposures.
3. It appears increasingly probable that noise exposures incurred early in one's working career, may be causally associated with increased hearing loss in subsequent years, including at least some hearing loss traditionally associated with age-related hearing loss.

The importance of these findings must not be underestimated. If, after the internal and peer-reviews are completed and the above conclusions are substantiated, then these findings have implications regarding the possible need to re-visit the current U.S. hearing damage-risk criteria.

Early Career Scientist Winner 2014

Michael Flynn, MA

Since receiving the 2014 Director's Award for Extraordinary Intramural Science in the category of Early Career Scientist, Mr. Flynn has continued to serve as the project officer for a broad, multifaceted research program addressing the occupational health of immigrant workers. The \$5,000 award was used to support and strengthen the collaboration with the Mexican Ministry of Governance to document and improve occupational safety and health (OSH) outcomes of Mexicans working in the United States. In 2015, this collaboration resulted in the publication of a comprehensive set of educational materials, including 8 pamphlets, 10 short worker testimonial videos, and 4 posters, that aim to raise awareness among Spanish-speaking immigrant workers of basic OSH issues at work. These products provide tools and motivation for those workers to seek additional information and assistance about their OSH concerns. The final materials were field tested in the Mexican consulates of Los Angeles and Atlanta over nine months and are currently being distributed in the 50 Mexican consulates across the United States. More importantly, this project has led to the integration of OSH as a central concern for the Mexican government's work with their diaspora in the United States. This partnership has also led to an exploration of repurposing routine data collected by the consulates for occupational health surveillance purposes. As a result of this collaboration

researchers at the University of Georgia reviewed death certificate data collected by the Mexican consulate in Atlanta. This pilot effort resulted in a manuscript entitled “Construction industry employment and mortality among Mexican immigrants in the Southeastern United States, 2003-2013” which is currently under review by the American Journal of Industrial Medicine. The collaboration between NIOSH and the Mexican Foreign Ministry has been highlighted in a special issue of Public Health Reports and was the NIOSH nominee for the 2014 CDC Honor Award for Excellence in International Partnership.

Over the past year Mr. Flynn also led the Overlapping Vulnerabilities Team at NIOSH in developing a partnership with the American Society of Safety Engineers (ASSE) to improve access to OSH information, resources, and support for young Hispanic immigrants working in small construction businesses and facilitating research with them. This Team co-published a report in 2015 with the ASSE entitled “Overlapping Vulnerabilities: The Occupational Safety and Health of Young Workers in Small Construction Firms”. On a theoretical level, this report presents a more comprehensive model for understanding occupational health disparities. On a practical level, it has prompted the ASSE to initiate an intervention effort to address the increased risks faced by workers experiencing overlapping OSH vulnerabilities in small construction businesses. This intervention effort has grown to involve additional participants such as the Center for Construction Research and Training, The Laborers' Health Safety Fund of North America, The National Alliance of Latin American and Caribbean Communities, and the Occupational Safety and Health Administration. This group, led by ASSE, has developed an assessment tool to better understand the current training practices among small construction businesses which employ Hispanic immigrants, and has formulated a pilot project aimed at understanding the value and utility of Spanish-language tool box talks for use in small construction businesses. The Overlapping Vulnerabilities team was the NIOSH nominee for the 2015 CDC Honor Award for Excellence in Domestic Partnership.

Mr. Flynn continues to collaborate on several internal and external research studies and outreach efforts addressing issues of occupational health equity. He serves as chair of the research committee of the National Advisory Board of the Ventanillas de Salud program and is the assistant coordinator for the National Occupational Research Agenda Occupational Health Equity program at NIOSH. Since receiving this award he has authored and co-authored eleven publications and has given 14 presentations at professional meetings including three keynote presentations at venues including the 45th National and International Safety Congress and the ASSE Symposium on Construction Safety.

Scientific Support Winner 2014

John Clark

Since receiving the 2014 Director's Award for Extraordinary Intramural Science in the category of Scientific Support, John Clark has continued his long standing tradition of providing technical and logistical support to project officers in the Biomonitoring and Health Assessment Branch, Division of Applied Research and Technology. He used his award to purchase consumable supplies for his team including syringes, needles, sharps containers, burn boxes, shipping containers and dry ice for shipping frozen biological samples (blood, urine) from field sites back to NIOSH for analysis. A portion of his award was allocated to the purchase of a new label maker needed to affix unique CDC sample numbers to all samples. Mr. Clark continued to participate in occupational field studies with his branch colleagues as well as assisting researchers from another division. When not actually traveling he served a vital role of field study coordinator assisting researchers with packing and unpacking equipment and supplies needed for field investigations. Mr. Clark retired unexpectedly in October 2015 due to a family illness. He sincerely appreciated the Director's Award he received and he was pleased that his monetary award could further the mission of his team, branch and division.

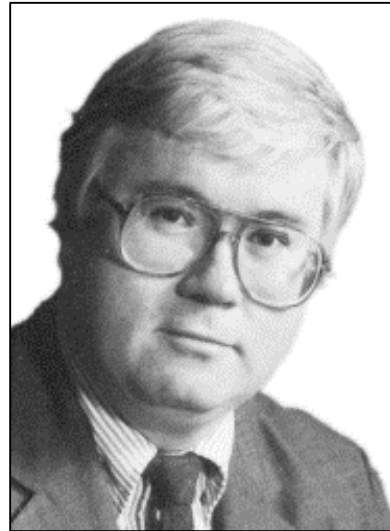
Previous Director's Intramural Award for Extraordinary Science (DIA) Winners

View the previous winners of the [Director's Intramural Award for Extraordinary Science \(DIA\)](#).

James P. Keogh Award for Outstanding Service in Occupational Safety and Health

The National Institute for Occupational Safety and Health (NIOSH) is pleased to recognize one current or former NIOSH employee each year for exceptional service to the field of occupational safety and health. This award honors the contributions made by public health workers who fight long odds to achieve safer and healthier workplaces.

James P. Keogh, M.D., was a tireless advocate for worker safety and health who died in June 1999 at the age of 49. His earliest work in academic medicine identified dimethylaminopropionitrile as the causal agent in an outbreak of bladder neuropathy in the 1970s. Dr. Keogh was able to make this determination because, unlike many of the clinicians initially contacted by the workers, he took their complaints seriously and applied clear public health principles to his investigation. Throughout his life, he listened carefully to workers, characterized hazards and diseases, and then fearlessly worked to identify compensation for the individual and prevention strategies for others. Dr. Keogh was instrumental in including construction workers in the Maryland Occupational Safety and Health lead standard, a full decade before the federal standard did the same. He was a leading medical educator who always focused on the need to incorporate clinical compassion with public health prevention. His most outstanding legacy, however, was his fierce determination to put knowledge into practice to benefit the worker.



James P. Keogh Award Winner

Dr. Thomas R. Waters

Dr. Thomas R. Waters had a remarkable and distinguished 24-year career in occupational safety and health at NIOSH, highlighted by his seminal contributions to research on work-related musculoskeletal disorders (MSDs). Dr. Waters' research had significant impact in the manufacturing, retail trade, warehousing and healthcare sectors, enabling the protection of countless under-served workers.

He initially focused on methods for assessing the biomechanical demands of manual material handling; this work culminated in 1991 with one of his most notable scientific contributions to ergonomics-- the widely used Revised NIOSH Lifting Equation (RNLE). The equation is used both domestically and abroad by countless health and safety professionals in every industrial sector as the basis of ISO Standards on lifting. Prior to retirement, Dr. Waters, with other researchers from NIOSH, the U.S. Army and U.S. Navy, developed provisional recommendations and weight limits for pregnant workers performing manual handling tasks at various stages across their pregnancies. Dr. Waters was also an internationally-recognized expert in safe patient handling and movement and developed safe patient lifting algorithms with various groups. He was instrumental in the development of Safe Patient Handling and Movement conferences now held annually across the country.



Dr. Waters was also interested in MSDs among youth working in agriculture. He collaborated with university researchers on developing a two-dimensional biomechanical model designed for adolescents and ergonomic interventions for tasks frequently performed by youths on family farms. With others, he developed the methodology and instrumentation to study bone quantity and quality of farm youths. The preliminary evidence indicated that farm-related physically demanding tasks performed by youths may lead to bone changes that predispose farm adolescents to degenerative skeletal disorders later in life.

Dr. Waters retired from NIOSH in December 2012. To our great sadness, Tom passed away suddenly and tragically in October 2014, leaving behind an incomparable legacy in occupational safety and health research. Dr. Waters' passing has resulted in a groundswell of recognition of his accomplishments across the ergonomics community including at the Applied Ergonomics Conference in March 2016 and a Human Factors and Ergonomics Society Special Issue on his accomplishments released this spring. In May 2015, his colleagues created the Thomas R. Waters Memorial Scholarship for Ergonomics Research

through the CDC Foundation to be awarded annually to a deserving student in the field of occupational ergonomics.

Previous James P. Keogh Award Winners

2015: [Kathleen Kreiss](#)

2014: [Albert E. Munson](#)

2013: [Michael Attfield](#)

2012: [Alice Suter](#)

2011: [Linda Rosenstock](#)

2010: [James W. Collins](#)

2009: [John Howard](#)

2008: [Mitch Singal](#)

2007: [Steven Sauter](#)

2006: [Marilyn Fingerhut](#)

2005: [Rosemary Sokas](#)

2004: [Dawn Castillo](#)

2003: [James A. Merchant](#)

2002: [Philip J. Landrigan](#)

2001: [William Edward Halperin](#)

2000: [Richard A. Lemen](#)

Charles C. Shepard Science Award

CDC/ATSDR established the Charles C. Shepard Science Award in 1986 in honor of Dr. Charles C. Shepard, M.D., an internationally recognized microbiologist whose career was marked by a pursuit of scientific excellence. He served as chief of the Leprosy and Rickettsia Branch at CDC for more than 30 years, until his death on February 18, 1985. The Charles C. Shepard Science Award recognizes scientists who have made important research contributions to public health. The awards are given in five categories: one individual award—Lifetime Scientific Achievement—and four for journal articles during the previous year in the following categories:



- Assessment
- Data Methods and Study Design
- Laboratory Science
- Prevention and Control
- NIOSH Nominations for the Charles C. Shepard Science Award

NIOSH Nominations for the Charles C. Shepard Science Award

Assessment

Bailey RL, Cox-Ganser JM, Duling MG, LeBouf RF, Martin SB Jr., Bledsoe TA, Green BJ, Kreiss K [2015]. Respiratory morbidity in a coffee processing workplace with sentinel obliterative bronchiolitis cases. *Am J Ind Med* 58(12):1235–1245.

Charles LE, Burchfiel CM, Sarkisian K, Li S, Miller DB, Gu JK, Fekedulegn D, Violanti JM, Andrew ME [2015]. Leptin, adiponectin, and heart rate variability among police officers. *Am J Hum Biol* 27(2):184–191.

Daniels RD, Bertke S, Dahm MM, Yiin JH, Kubale TL, Hales TR, Baris D, Zahm SH, Beaumont JJ, Waters KM, Pinkerton LE. Exposure–response relationships for select cancer and non-cancer health outcomes in a cohort of US firefighters from San Francisco, Chicago and Philadelphia (1950–2009). *Occup Environ Med* 72(10):699–706.

Fent KW, Evans DE, Booher D, Pleil JD, Stiegel MA, Horn GP, Dalton J [2015]. Volatile organic compounds off-gassing from firefighters' personal protective equipment ensembles after use. *J Occup Environ Hyg* 12(6):404–414.

Data Methods and Study Design

Wheeler MW, Shao K, Bailer AJ [2015]. Quantile benchmark dose estimation for continuous endpoints. *Environmetrics* 26(5):363–372.

Laboratory Science

Kisin ER, Yanamala N, Farcas MT, Gutkin DW, Shurin MR, Kagan VE, Bugarski AD, Shvedova AA [2015]. Abnormalities in the male reproductive system after exposure to diesel and biodiesel blend. *Environ Mol Mutagen* 56(2):265–276.

Marshall NB, Lukomska E, Long CM, Kashon ML, Sharpnack DD, Nayak AP, Anderson KL, Meade BJ, Anderson SE [2015]. Triclosan induces thymic stromal lymphopoietin in skin promoting Th2 allergic responses. *Toxicol Sci* 147(1):127–139.

Zaccone EJ, Goldsmith WT, Shimko MJ, Wells JR, Schwegler-Berry D, Willard PA, Case SL, Thompson JA, Fedan JS [2015]. Diacetyl and 2,3-pentanedione exposure of human cultured airway epithelial cells: ion transport effects and metabolism of butter flavoring agents. *Toxicol Appl Pharmacol* 289(3):542–549.

Prevention and Control

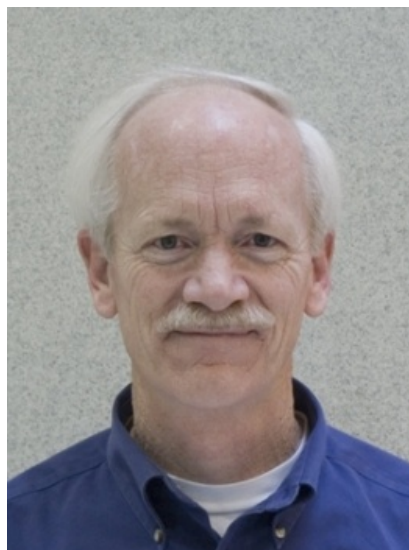
Hsiao H, Whitestone J, Wilbur M, Lackore JR, Routley JG [2015]. Seat and seatbelt accommodation in fire apparatus: anthropometric aspects. *Appl Ergon* 51:137–151.

Lifetime Scientific Achievement Award

Cecil (Buzz) Burchfiel

This year, NIOSH is proud to nominate Dr. Cecil (Buzz) Burchfiel for the Charles C. Shepard Lifetime Scientific Achievement Award. Since joining NIOSH in 2001, Dr. Burchfiel is responsible for establishing, coordinating, expanding, and maintaining one of the most successful and integrated research efforts assessing associations between occupational stress and subclinical cardiovascular disease (CVD) in police officers. A history of working as a police officer leads to an average age at death 10 years younger than that of the general US population. It is also associated with higher prevalence of CVD morbidity. This health disparity increases as officers age and retire.

Dr. Burchfiel was instrumental in developing the pilot study of 100 randomly selected police officers (which later led to the full NIOSH Buffalo



Cardio-metabolic Occupational Police Stress [BCOPS] Study) while assuming management and leadership responsibilities of the then-recently established Biostatistics Branch. Under his leadership, he established the core of that branch's occupational epidemiology research mission, justifying transformation of the branch into the Biostatistics and Epidemiology Branch (BEB) in 2003. Dr. Burchfiel has made significant contributions to the study of occupational exposures that may increase risk of subclinical cardiovascular and metabolic diseases. This is evidenced by the establishment of a longitudinal cohort study of workplace stress and subclinical CVD among police officers. This study has led to identification of important exposures including different sources of police work stress (e.g., administrative, organizational support, and psychological/physical danger), shift work, and long work hours. This knowledge can inform institutional practices to help protect the workforce. This research also serves as a resource for public health training and teaching MPH and PhD students, enhancing knowledge and skills for further research and prevention effort.

The BCOPS Study was originally conceived because the determinants and health consequences of police exposure to occupational stressors had not been adequately investigated. This study began as a \$1.5 million contract in collaboration with academic colleagues of the State University of New York (SUNY) at Buffalo. The study began as a joint conceptual and operational effort to integrate psychological and pathophysiological concepts of stress by sharing and integrating the expertise of scientists between SUNY and NIOSH. From the beginning, Dr. Burchfiel initiated partnerships with external researchers at the National Institute of Justice, the University of South Carolina, the University of Georgia, Wayne State and Washington State University.

Dr. Burchfiel also had the foresight to establish an archived specimen bank resource that would enable future measurements of new stress and disease biomarkers. Using the most current scientific research findings as a guide, Dr. Burchfiel and his team have utilized the frozen serum collected from the police officers to measure a series of novel biomarkers. Biomarkers have been widely used in epidemiologic research as a way of directly measuring biological processes and understanding disease in its earliest stage. In the BCOPS Study, Dr. Burchfiel selected emerging biomarkers which have been associated with CVD through biological processes involving inflammation, dyslipidemia, endothelial dysfunction, hemostasis, thrombosis and endocrine function. This selection of emerging biomarkers was based on careful review of the scientific literature; the selection only included biomarkers that demonstrated precision and strong reliability and validity. Inclusion of these biomarkers allows for comparison with traditional biomarkers.

Dr. Burchfiel is the lead author or co-author of 175 peer-reviewed scientific publications. In addition, he has given numerous presentations at national and international conferences. Since his tenure at CDC began 15 years ago, 39 abstracts have been published, 173 oral or poster presentations have been given at conferences, and 92 journal articles published in the peer-reviewed scientific literature. Three papers are currently accepted and six papers have been submitted. This is an extraordinary level of productivity.

In addition to his research vision and leadership for the Program, Dr. Burchfiel has mentored the many scientists who have reported directly to him, and at least three of the scientists have been engaged in research that further expand and enhance the BCOPS study

Nomination for this prestigious award recognizes not only Dr. Burchfiel's outstanding contribution to occupational safety and health, but also his dedication and commitment to the NIOSH mission.



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through research and prevention**

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